WHAT IS CLAIMED IS:

1. A method for non-contact measurement of a displacement between a surface and a capacitive sensor comprised of at least two superimposed conductive plates electrically insulated one from the other and a sensor circuit coupled to the plates, said method comprising:

(a) positioning said capacitive sensor proximate to the surface such that the displacement is a distance of a gap between the surface and one of the plates;

(b) applying a high frequency signal to the plates;

(c) applying the high frequency signal and a signal from a sensor plate of the conductive plates to control a voltage gain of an amplifier in the circuit, said signal from the sensor plate being indicative of the displacement between the sensor and the surface;

(d) differentiating an output of the amplifier and the high frequency signal, and

(e) determining a value of the displacement based on the difference between the output of the amplifier and the high frequency signal.

2. The method as in claim 1 wherein differentiating further comprises sensing a difference between a peak of the output of the amplifier and a peak of the high frequency signal.

3. The method as in claim 1 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier.

4. The method as in claim 1 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier and applying the output of the amplifier as feedback to the signal from the sensor plate.

5. The method as in claim 1 wherein differentiating further comprises linearizing the difference between the output of the amplifier and the high frequency signal.

6. The method as in claim 1 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier, and wherein differentiating further comprises applying an output of the operational amplifier and the high frequency signal as inputs to a difference amplifier which generates a cyclical difference signal indicative of the gap, and applying the cyclical difference signal to a peak detector which generates a signal indicative of a peak value of the cyclical signal, and wherein said peak value is indicative of the gap.

7. The method as in claim 1 wherein said at least two superimposed conductive plates further comprises the sensor plate, an active shield plate and a passive shield plate, wherein said high frequency signal is applied to the sensor plate and to the active shield plate, and said passive shield plate is insulated from the active shield plate and the sensor plate, and said method further comprises connecting the passive shield plate to a ground via a resistive connection.

8. The method as in claim 1 wherein said at least two superimposed conductive plates further comprises the sensor plate, an active shield plate and a passive shield plate, wherein said high frequency signal is applied to the sensor plate and to the active shield plate, and said passive shield plate is insulated from the active shield plate and the sensor plate, and said method further comprises grounding the passive shield plate and coupling the passive shield plate to the high frequency signal via a resistive conductive path.

9. The method as in claim 8 further comprising monitoring the high frequency signal for a direct current (dc) signal induced by the coupling of the passive shield plate and, when a dc signal is detected, inhibiting the determination of the value of the displacement.

10. A method for measurement of a characteristic of a medium proximate a capacitive sensor comprised of at least three superimposed conductive plates electrically insulated from each other and a sensor circuit coupled to the plates, wherein said plates include a sensor plate, an active shield plate sandwiched between a sensor plate and a passive shield plate, said method comprising:

(a) positioning the capacitive sensor proximate to the medium, such that the medium is capacitively coupled to the sensor plate;

(b) applying a high frequency signal to the sensor plate and to the active shield plate, wherein the medium affects a response of the sensor plate to the high frequency signal;

(c) applying a signal induced on the sensor circuit by the high frequency signal and the sensor plate to control a voltage gain of an amplifier in the circuit, said applied sensor signal being indicative of the medium;

(d) differentiating the output of the amplifier and the high frequency signal, and

(e) determining a value indicative of the medium based on the difference between the applied signal and the high frequency signal.

11. The method as in claim 10 wherein the medium is a gap between the sensor plate and a surface, and the value is a distance across the gap.

12. The method as in claim 10 wherein the gap is filled with a non-conductive medium and the distance is a thickness of the non-conductive medium.

13. The method as in claim 10 wherein the medium is a fluid and the value is indicative of a dielectric of the fluid.

14. The method as in claim 10 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier, and wherein differentiating further comprises applying an output of the operational amplifier and the high frequency signal as inputs to a difference amplifier which generates a cyclical difference signal indicative of the gap, and applying the cyclical difference signal to a peak detector which generates a signal indicative of a peak value of the cyclical signal, and wherein said peak value is indicative of the gap.

15. The method as in claim 10 wherein said method further comprises grounding the passive shield plate.

16. The method as in claim 10 wherein said method further coupling the passive shield plate to the high frequency signal via a resistive conductive

path and connecting the passive shield plate to a ground via a resistive connection.

17. The method as in claim 16 further comprising monitoring the high frequency signal for a direct current (dc) signal shift induced by a change in the coupling of the passive shield to ground and, when a dc signal shift is detected, inhibiting the determination of the value of the displacement.

18. A non-contact capacitive sensor comprising:

a sensor plate which is configured to be displaced from which a surface to measure a capacitance of a gap between the surface and sensor plate;

an active shield plate over said sensor plate and insulated from said sensor plate, wherein a high frequency input signal is applied to the active shield plate and sensor plate;

an effective ground shield plate connected through a first resistor to a ground, over said active shield plate so as to sandwich the active shield plate between the ground shield plate and the sensor plate and said ground shield plate is insulated from the active shield plate;

a second resistor connected between the passive shield and the active shield providing a dc path through the sensor .

19. The non-contact capacitive sensor of claim 18 wherein said plates are superimposed one over another.

20. The non-contact capacitive sensor of claim 18 wherein said plates are laminated together with insulation between each plate.

21. The non-contact capacitive sensor of claim 18 further comprising a capacitance between the active plate and sensor plate, and a second capacitance between the active shield plate and the passive shield plate.

22. The non-contact capacitive sensor of claim 18 wherein said sensor plate has a planar surface facing the surface.

23. The non-contact capacitive sensor of claim 18 wherein the sensor plate and active shield plate further comprise connections to a sensor circuit.

24. A method for non-contact measurement of a dielectric related characteristic of a medium between a surface and a capacitive sensor comprised of at least two superimposed conductive plates electrically insulated one from the other and a sensor circuit coupled to the plates, said method comprising:

(a) positioning said capacitive sensor proximate to the surface such that the medium is

between the surface and a sensor plate of the plates;

(b) applying a high frequency signal to the plates and a dielectric of the medium affects a response signal of the sensor plate to the high frequency signal;

(c) applying the high frequency signal and the response signal from the sensor plate to control a voltage gain of an amplifier in the circuit, said response signal being indicative of the medium between the sensor and surface;

(d) differentiating an output of the amplifier and the high frequency signal, and

(e) determining a value of the displacement based on the difference between the output of the amplifier and the high frequency signal.

25. The method as in claim 24 wherein the medium is a gap between the sensor plate and a surface, and the value is a distance across the gap.

26. The method as in claim 24 wherein the gap is filled with a non-conductive medium and the distance is a thickness of the non-conductive medium.

27. The method as in claim 24 wherein the medium is a fluid and the value is indicative of a dielectric of the fluid.

28. A method for non-contact measurement of a medium proximate to a capacitive sensor comprised of at least two superimposed conductive plates electrically insulated one from the other and a sensor circuit coupled to the plates, said method comprising:

(a) positioning said capacitive sensor proximate to the medium;

(b) applying a high frequency signal to the plates;

(c) applying the high frequency signal and a signal from a sensor plate of the conductive plates to control a voltage gain of an amplifier in the circuit, said signal from the sensor plate being indicative of a property of the medium;

(d) differentiating an output of the amplifier and the high frequency signal, and

(e) determining a value of the property of the medium based on the difference between the output of the amplifier and the high frequency signal.

29. The method as in claim 28 wherein the medium is a fluid and the property is a depth of the fluid.

30. The method as in claim 28 wherein the medium is a solid and the property is a thickness of the solid.

31. The method as in claim 28 wherein the medium is a fluid and the property is a degree of impurities in the fluid.

32. The method as in claim 28 wherein the medium is a solid and the property is a degree of impurities in the soild.

33. The method as in claim 28 and differentiating further comprises sensing a difference between a peak of the output of the amplifier and a peak of the high frequency signal.

34. The method as in claim 28 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier.

35. The method as in claim 28 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier and applying the output of the amplifier as feedback to the signal from the sensor plate.

36. The method as in claim 28 wherein differentiating further comprises linearizing the difference between the output of the amplifier and the high frequency signal.

37. The method as in claim 28 wherein controlling the gain further comprises applying the signal from the sensor plate and the high frequency signal as inputs to an operational amplifier, and wherein differentiating further comprises applying an output of the operational amplifier and the high frequency signal as inputs to a difference amplifier which generates a cyclical difference signal indicative of the property, and applying the cyclical difference signal to a peak detector which generates a signal indicative of a peak value of the cyclical signal, and wherein said peak value is indicative of the property.

38. The method as in claim 28 wherein said at least two superimposed conductive plates further comprises the sensor plate, an active shield plate and a passive shield plate, wherein said high frequency signal is applied to the sensor plate and to the active shield plate, and said passive shield plate is insulated from the active shield plate and the sensor plate, and said method further comprises connecting the passive shield plate to a ground via a resistive connection.

39. The method as in claim 28 wherein said at least two superimposed conductive plates further comprises the sensor plate, an active shield plate and a passive shield plate, wherein said high

frequency signal is applied to the sensor plate and to the active shield plate, and said passive shield plate is insulated from the active shield plate and the sensor plate, and said method further comprises grounding the passive shield plate and coupling the passive shield plate to the high frequency signal via a resistive conductive path.

40. The method as in claim 28 further comprising monitoring the high frequency signal for a direct current (dc) signal induced by the coupling of the passive shield plate and, when a dc signal is detected, inhibiting the determination of the value of the displacement.